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coincide with DC . Draw AI parallel and AK perpendicular to DC and let $EFGH$ be the rectangle.

Then $\frac{1}{2}(AI+DC) \times AK = EF \times FG + FG \times GC + \frac{1}{2}(AI+EF)(AK-KR')$.
But $AK=11.2$ inches, $AI=7.8$ inches. $\therefore 588=28 EF+33FG$.

\therefore for maximum $28 EF=33 FG$. $\therefore EF=10.5$ inches, $FG 8.91$ inches.

26. Proposed by J. F. W. SCHEFFER A. M., Hagerstown, Maryland.

$ABCD$ represents a triangle, and $ABEF$ a trapezoid which is perpendicular to the rectangle, both figures having the side AB common to each other, and ADF and BCE forming two right triangles perpendicular to the rectangle $ABCD$. To determine the conoidal surface $CDFE$ so as to satisfy the condition that any plane laid through AB will interest it in a straight line. Also find volume of the surface thus formed.

Solution by the PROPOSER.

Let $BC=AD=h$, $AB=a$, $BE=b$, $AF=c$. Let P represent a point in the surface, and put $AR=x$, $RQ=y$, $PQ=z$

The triangles BGK , PQR , and AHI are similar, and we may now put $AH=ny$, $IH=nz$, $BG=my$, $KG=mz$; but $h : mz = b - my$; $h : nz = c : c - nz$, whence $m = \frac{bh}{hy+bz}$, $n = \frac{ch}{hy+cz}$.

In the trapezoid $AHGB$, we now have

$$AB=a, AH=\frac{chy}{hy+cz}, BG=\frac{bhy}{hy+bz}, AR=x,$$

$$RQ=y. \therefore (AH+y)x+(BG+y)(a-x)=(AH+BG)a.$$

Substituting, clearing of fractions, and arranging, we find for the equation of the surface

$$abcz^2 + a(b+c)hyz - (b-c)h^2xy + ah^2y^2 - abhz - ach^2y = 0.$$

Let us now denote $\angle CBK = \angle DAI$ by θ , and angles BCK and ADI

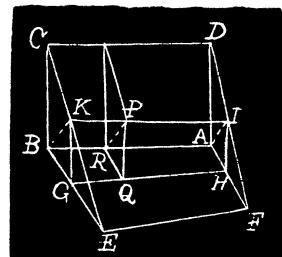
$$\begin{aligned} & \text{represent by } C \text{ and } D. \text{ For the volume we have } \frac{1}{6}ah^2 \int_0^{\pi/2} \left[\frac{\sin^2 C}{\sin^2(C+\theta)} \right. \\ & + \frac{\sin^2 D}{\sin^2(D+\theta)} + \frac{\sin C \sin D}{\sin(C+\theta) \sin(D+\theta)} \left. \right] d\theta = \frac{1}{6}ah^2 \left[\tan C + \tan D \right. \\ & + \left. \frac{\tan C \tan D}{\tan C - \tan D} \log \frac{\tan C}{\tan D} \right] \text{ but } \tan C = \frac{b}{h}, \tan D = \frac{c}{h}; \end{aligned}$$

$$\therefore \text{volume} = \frac{1}{6}ah \left[b+c + \frac{bc}{b-c} \log \frac{b}{c} \right].$$

27. Proposed by ADOLPH BAILOFF, Durand Wisconsin.

A line BF , that bisects an angle exterior to the vertical angle of an isosceles triangle is parallel to the base AC .

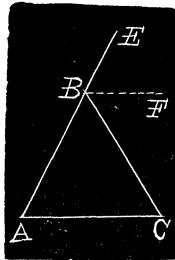
Solution by Mrs. MARY E. HOGSETT, Danville, Kentucky; P. S. BERG, Apple Creek, Ohio, Professors JOHN FAUGHT, Bloomington, Indiana; and M. A. GRUBER, War Department, Washington, D. C.



$$\angle EBC = \angle A + \angle C = 2\angle C.$$

But $\angle EBC = 2\angle FBC$, since BF is the bisector of $\angle EBC$. $\therefore 2\angle FBC = 2\angle C$, or $\angle FBC = \angle C$.

Hence, BF is parallel to AC , because if two straight lines are cut by a third straight making the alternate interior angles equal, the two lines are parallel.



Solutions were also received from J. K. ELLWOOD, H. G. WHITAKER, and G. B. M. JERR.

NOTE—No solution has yet been received to problem 20.



CALCULUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

20. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

$$\int_0^{\frac{1}{2}\pi} \sqrt{[(1-e^2 \cos^2 \phi)(1-e^2 \sin^2 \phi)]} d\phi = \text{what?}$$

Solution by Professor J. F. W. SCHEFFER, A. M., Hagerstown, Maryland.

$$\begin{aligned} \sqrt{(1-e^2 \cos^2 \phi)(1-e^2 \sin^2 \phi)} &= \sqrt{1-e^2 (\cos^2 \phi + \sin^2 \phi) + e^4 \sin^2 \phi \cos^2 \phi} \\ &= \sqrt{1-e^2 + \frac{e^4}{4} \sin^2 2\phi} = \sqrt{1-e^2 + \frac{e^2}{4} - \frac{e^4}{4} \cos^2 2\phi} \\ &= \frac{1}{2} \sqrt{(2-e^2)^2 - e^4 \cos^2 2\phi} = \frac{1}{2} \sqrt{(2-e^2)^2 - e^4 \sin^2 \left(\frac{\pi}{2} - 2\phi\right)} \\ &= \frac{1}{2}(2-e^2)^2 \sqrt{1 - \frac{e^4}{(2-e^2)^2} \sin^2 \left(\frac{\pi}{2} - 2\phi\right)}. \end{aligned}$$

$$\begin{aligned} \therefore \int_0^{\frac{\pi}{2}} d\phi \sqrt{(1-e^2 \cos^2 \phi)(1-e^2 \sin^2 \phi)} \\ &= -\frac{1}{4}(2-e^2) \int_{\frac{\pi}{2}}^{-\frac{1}{2}\pi} d\left(\frac{\pi}{2} - 2\phi\right) \sqrt{1 - \frac{e^4}{(2-e^2)^2} \sin^2 \left(\frac{\pi}{2} - 2\phi\right)} \\ &= \frac{1}{4}(2-e^2) \int_{-\frac{1}{2}\pi}^{+\frac{1}{2}\pi} d\lambda \sqrt{1 - \frac{e^4}{(2-e^2)^2} \sin^2 \lambda} \end{aligned}$$